

ToolKit

Concept: Parametrics (lines)

sect. 6.1

Parametric equations: x & y -variables each written as a function of a 3rd variable, or parameter, t .

$$x_t = x_0 + at$$

a - controls x -axis stretch

$$y_t = y_0 + bt$$

b - controls y -axis stretch

x_0 - x -coordinate when $t=0$

y_0 - y -coordinate when $t=0$

endpoints: plug max/min t -values in
to x_t and y_t

Slope: $\frac{b}{a}$

ToolkitConcept! Eliminating ParameterSect. 6.2Rule/Formula

given two parametric equations $x_t + y_t$, solve for t on the x -eq. and substitute into the y -eq. for t .

Example:

$$\begin{array}{lcl}
 x = t + 1 & \rightarrow & x - 1 = \underline{t} \\
 y = t^2 & & \downarrow \\
 & & y = (x - 1)^2
 \end{array}
 \Rightarrow y = (x - 1)^2$$

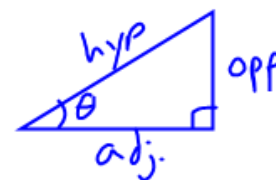
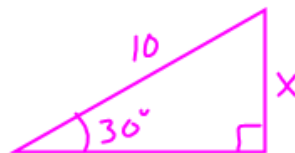
Reminders:

check the endpoints on the parametrics (see above) to see if you need to restrict function.

Toolkitconcept: Basic Trig ratiossect. 6.3Rule: $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

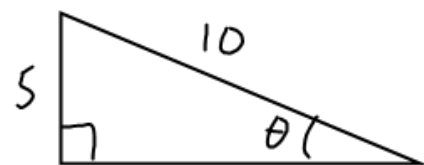
$\cos \theta = \frac{\text{adj}}{\text{hyp}}$

$\tan \theta = \frac{\text{opp}}{\text{adj}}$

To find side length:

$$\sin(30^\circ) = \frac{x}{10} \quad x = 10 \sin(30^\circ)$$

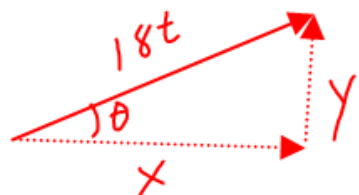
$$x = 5$$

To find Angle:

$$\sin \theta = \frac{5}{10}, \quad \theta = \sin^{-1}\left(\frac{5}{10}\right)$$

$$\theta = 30^\circ$$

Any Motion can be broken into horz. + vertical components.



$$x = 18t \cos \theta \quad y = 18t \sin \theta$$

Hints:

→ make sure you are in degree mode.

→ Only for right triangles (for now)

ToolkitConcepts: Parametric ShapesSection 6.4Rule:

$$\begin{aligned} x &= r \cos(t^\circ) \\ y &= r \sin(t^\circ) \end{aligned} > \text{gives a circle}$$

Basic setup

$$t_{\text{-min}} = 0$$

$$t_{\text{-max}} = 360$$

$$t_{\text{-step}} = 1-5$$

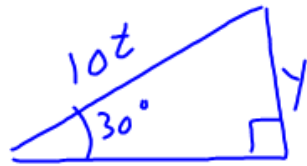
- $t_{\text{-min}}$ controls first pt plotted
- $t_{\text{-max}}$ controls # of rotations (360=1, 720=2) - may need to adjust by adding $t_{\text{-min}}$ if $t_{\text{-min}} \neq 0$
- $t_{\text{-step}}$ controls # of pts plotted, $360 \div \# \text{sides}$
- r controls radius
- add to x to shift r+/left
- add to y to shift up/down
- add inside w/ t to rotate,

$$\begin{aligned} x &= 3 \cos(t + 45) \\ y &= 3 \sin(t + 45) \end{aligned} > \text{rotates } 45^\circ$$

ToolkitConcept: Wind + river problemsSect. 6.5Rule:

→ Any motion can be broken into horz + vert components
(x) (y)

→ Put velocity along with time along actual path, then
Use $\cos\theta$ and $\sin\theta$ to find x + y components



$$x = 10t \cos(30^\circ)$$

$$y = 10t \sin(30^\circ)$$

→ If there is a wind or current, make components for that also

Hints

→ ① Picture ② Equations ③ time or angle

→ Distances usually plugged in for x & y

ToolkitConcept: Wind + river (adv.) - cross currentsSec. 6.6Rule:

- Break the plane into its two components
- Break the wind into its two components
- Model the overall motion by adding the two x-components and two y-components
- To get a plane to move straight east or west, the y-comp. of the plane plus the y-component of the wind = 0, then solve for θ .
- To get a plane to move straight North or South, the x-comp of the plane plus the x-comp. of the wind = 0, then solve for θ .

Hint

- picture, equations, ^{Solve for} angle
- Use common sense
- convert to heading in most cases